Competency 1.29 **EH Residents shall demonstrate a familiarity level knowledge of safety in specialized construction activities.**

1. Supporting Knowledge and Skills

a. Describe the hazards and protective systems and how they apply to the following areas associated with trenching and excavation:
   - Soil characterizations
   - Shoring
   - Access
   - Confined space

b. Describe the special safety considerations for the following activities involved in steel erection.
   - Elevated work/fall protection
   - Material handling equipment
   - Rigging applications
   - Load paths

c. Discuss the safety requirements for construction activities involving concrete and masonry. Include construction of forms and handling of equipment.

2. Self-Study Activities (corresponding to the intent of the above competency)

Below are two web sites containing many of the references you may need.

Web Sites		
Organization	**Site Location**	**Notes**
Department of Energy	http://wastenot.inel.gov/cted/stdguido.html	DOE Standards, Guides, and Orders
OSHA	http://www.osha-slc.gov/	OSHA documents and search engine
U.S. House of Representatives	http://law.house.gov/cfr.htm	Searchable Code of Federal Regulations

Scan 29 CFR 1926, Subpart P, *Excavations*.

Scan OSHA 2202, *Construction Industry Standards*.

EXERCISE 1.29-A Referring to 29 CFR 1926, Subpart P, *Excavations,* describe: (1) the factors affecting soil stability in a trench and (2) the protective shoring systems applied when a hazard is identified.

EXERCISE 1.29-B With regard to excavations, describe the characteristics of a confined space.

EXERCISE 1.29-C Define “limited access zone” as it relates to construction activities.

EXERCISE 1.29-D Referring to 29 CFR 1926, Subpart P, *Excavations*, discuss the general safety precautions taken to enter or limit access to an excavation.

Review 29 CFR 1926.105, “Safety Nets.”

NOTE: This Standard applies only to steel erection activity.

Review OSHA 2202, Construction Industry Standards.

EXERCISE 1.29-E Referring to 29 CFR 1926.105, “Safety Nets,” when should safety nets be provided?

EXERCISE 1.29-F Referring to 29 CFR 1926.105, “Safety Nets,” how far out should safety nets extend beyond the edge of the work surface?

Read 29 CFR 1910, Subpart N, “Materials Handling and Storage.”

Read 29 CFR 1910.179, *Overhead and Gantry Cranes*.

Review DOE/ID-10500, *Hoisting and Rigging Manual*.

EXERCISE 1.29-G Referring to 29 CFR 1910.179, *Overhead and Gantry Cranes*, describe the safety hazards associated with crane and gantry operation during material handling and storage activities.

EXERCISE 1.29-H Describe the purpose of the load rating for a crane.

Read 29 CFR 1926 Subpart Q, *Concrete and Masonry Construction*.

Scan OSHA 2202, *Construction Industry Standards*.

EXERCISE 1.29-I Referring to 29 CFR 1926 Subpart Q, *Concrete and Masonry Construction*, what are the requirements for constructing forms?

EXERCISE 1.29-J Referring to OSHA 2202, *Construction Industry Standards*, what are the basic requirements for concrete and masonry construction?

3. Summary

Specialized construction activities including trenching and excavation, steel erection, and concrete and masonry all require compliance with OSHA regulations. Although compliance with the law, including specific OSHA standards, is an important objective, an effective program looks beyond specific requirements of law to address all hazards. It will seek to prevent injuries and illnesses, whether or not compliance is at issue. The extent to which the program is described in writing is less important than how effective it is in practice. As the size of a worksite or the complexity of a hazardous operation increases, however, the need for written guidance increases to ensure clear communication of policies and priorities as well as a consistent and fair application of rules. DOE must comply to protect construction workers from accidents and injuries resulting from the premature removal of formwork, the failure to brace masonry walls, the failure to support precast panels, the inadvertent operation of equipment, and the failure to guard reinforcing steel.

4. Exercise Solutions

EXERCISE 1.29-A Referring to 29 CFR 1926, Subpart P, describe: (1) the factors affecting soil stability in a trench and (2) the protective shoring systems applied when a hazard is identified.

ANSWER 1.29-A There are a number of factors that affect soil stability in a trench. Some of the more common factors include the following:

- Nearby traffic
- Nearness of structures
- Condition of nearby structures
- Soil type (density, makeup)
- Surface and ground water (rain, runoff, water table)
- Overhead and underground utilities
- Weather

In 29 CFR 1926, Subpart P, “Excavations,” OSHA requires that, in all excavations, employees exposed to potential cave-ins must be protected by sloping, or benching the sides of the excavation; supporting the sides of the excavation; or placing a shield between the side of the excavation and the work area.

In general, 29 CFR 1926, Subpart P, “Excavations,” requires that a competent person inspect the following on a daily basis:

- excavations and the adjacent areas for possible cave-ins
- failures of protective systems and equipment
- hazardous atmospheres, or other hazardous conditions

If these conditions are encountered, OSHA requires exposed employees to be removed from the hazardous area until the necessary safety precautions have been taken. Inspections are also required after natural (e.g., heavy rains) or man-made events such as blasting that may increase the potential for hazards.

EXERCISE 1.29-B With regard to excavations, describe the characteristics of a confined space.

ANSWER 1.29-B A confined space has one or more of the following characteristics:

- Contains or has a potential to contain a hazardous atmosphere
- Contains a material that has the potential for engulfing an entrant
- Has an internal configuration such that an entrant could be trapped or asphyxiated by inwardly converging walls or by a floor that slopes downward and tapers to a smaller cross-section
- Contains any other recognized serious safety or health hazard

EXERCISE 1.29-C Define “limited access zone” as it relates to construction activities.

ANSWER 1.29-C A limited access zone is an area that is under construction and is clearly demarcated to limit access by employees.

EXERCISE 1.29-D Referring to 29 CFR 1926, Subpart P, “Excavations,” discuss the general safety precautions taken to enter or limit access to an excavation.

ANSWER 1.29-D The following general safety precautions apply to confined spaces:

Note: Each facility may add additional requirements depending on site-specific hazards.

- Complete a confined space entry permit.
- Confirm or perform training to establish personnel proficiency in the duties required.
- Test the atmosphere.
- Set up atmospheric monitoring to be performed throughout the entry. If a hazardous atmosphere is detected, evaluate to determine the cause.
- Take measures to protect employees before entry is made.
- Require proper respiratory equipment if needed.
- Allow entry only after all requirements of the permit are met and it is reviewed and signed by the entry supervisor or job leader.

EXERCISE 1.29-E Referring to 29 CFR 1926.105, “Safety Nets,” when should safety nets be provided?

ANSWER 1.29-E Safety nets shall be provided when workplaces are more than 25 feet above the ground or water surface or other surfaces where the use of ladders, scaffolds, catch platforms, temporary floors, safety wires, or safety belts is impractical.

EXERCISE 1.29-F Referring to 29 CFR 1926.105, “Safety Nets,” how far out should safety nets extend beyond the edge of the work surface?

ANSWER 1.29-F Nets shall extend 8 feet beyond the edge of the work surface.

EXERCISE 1.29-G Referring to 29 CFR 1910.179, *Overhead and Gantry Cranes*, describe the safety hazards associated with crane and gantry operation during material handling and storage activities.

ANSWER 1.29-G Serious hazards are overloading, dropping or slipping of the load caused by improper hitching or slinging, obstruction to the free passage of the load, or using equipment for a purpose for which it was not intended or designed." DOE/ID-10500, *Hoisting and Rigging Manual*, 2.1 "Operator Training."

EXERCISE 1.29-H Describe the purpose of the load rating for a crane.

ANSWER 1.29-H Each crane is required to have a rated capacity marked on the side of the crane to provide the operator with the information necessary for safe operation. The load rating provides the maximum working load allowed for the crane. A crane may not be loaded beyond its rated capacity except for test purposes.

EXERCISE 1.29-I Referring to 29 CFR 1926, Subpart Q, "Concrete and Masonry Construction," what are the requirements for constructing forms?

ANSWER 1.29-I 29 CFR 1926.703, Requirements for cast-in-place concrete(c)(ii) (2 - 7), states:
"(2) Forms shall be designed to prevent excessive distortion of the structure during the jacking operation.
(3) All vertical slip forms shall be provided with scaffolds or work platforms where employees are required to work or pass.
(4) Jacks and vertical supports shall be positioned in such a manner that the loads do not exceed the rated capacity of the jacks.
(5) The jacks or other lifting devices shall be provided with mechanical dogs or other automatic holding devices to support the slip forms whenever failure of the power supply or lifting mechanism occurs.
(6) The form structure shall be maintained within all design tolerances specified for plumbness during the jacking operation.
(7) The predetermined safe rate of lift shall not be exceeded."

EXERCISE 1.29-J Referring to OSHA 2202, what are the basic requirements for concrete and masonry construction?

ANSWER 1.29-J OSHA 2202 states the following general requirements about concrete and masonry construction:

a. No construction loads shall be placed on a concrete structure or portion of a concrete structure unless the employer determines, based on information received from a person who is qualified in structural design, that the structure or portion of the structure is capable of supporting the loads.
b. All protruding reinforcing steel, onto and into which employees could fall, shall be guarded to eliminate the hazard of impalement.
c. No employee shall be permitted to work under concrete buckets while buckets are being elevated or lowered into position.
d. To the extent practical, elevated concrete buckets shall be routed so that no employee, or the fewest number of employees, are exposed to the hazards associated with falling concrete buckets.
e. Formwork shall be designed, fabricated, erected, supported, braced, and maintained so that it will be capable of supporting without failure all vertical and lateral loads that may reasonably be anticipated to be applied to the formwork.
f. Forms and shores (except those used for slabs on grade and slip forms) shall not be removed until the employer determines that the concrete has gained sufficient strength to support its weight and superimposed loads. Such determination shall be based on compliance with one of the following:
    1. The plans and specifications stipulate conditions for removal of forms and shores, and such conditions have been followed, or
    2. The concrete has been properly tested with an appropriate American Society for Testing Materials (ASTM) standard test method designed to indicate the concrete compressive strength, and the test results indicate that the concrete has gained sufficient strength to support its weight and superimposed loads.